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10/071,207	02/11/2002	George Jonathan Kluth	52352-785	9267

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EXAMINER

GUERRERO, MARIA F

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 03/19/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/071,207

Applicant(s)

KLUTH ET AL.

Examiner

Maria Guerrero

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 December 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) 19 and 20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is in response to request for reconsideration filed December 23, 2003.

Claims 1-20 are pending.

Election/Restrictions

2. Applicant's election of Group I claims 1-18 in Paper No. 8 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Claims 19-20 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in Paper No. 8.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-3 and 5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331) in view of Applicant admitted prior art.

Bai teaches providing a semiconductor substrate (silicon) having an upper surface, a gate electrode formed on the upper surface of the substrate with a gate

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insulating layer therebetween, the gate electrode having an upper surface and source/drain regions (Fig. 5-7, col. 3, lines 50-65, col. 5, lines 20-30, 40-45). Bai discloses forming source/drain extensions having a dopant concentration, forming metal silicide contacts on the upper surface of the gate electrode and the substrate in a manner sufficient to maintain the dopant concentration in the source/drain extensions (Fig. 7-9, col. 6, lines 15-20, 25-45).

In addition, Bai shows the temperature being below about 700°C throughout the forming of the metal silicide contacts (col. 6, lines 42-44). Bai discloses the metal silicide contacts being NiSi formed at a temperature of approximately 400-600°C (col. 6, lines 42-44). Bai teaches depositing a dielectric layer over the substrate and the gate electrode upper surfaces, patterning the dielectric layer to form sidewall spacers, depositing a nickel layer over the gate electrode, the substrate, and the sidewall spacers (Fig. 5-8, col. 5, lines 49-52). Bai discloses heating to react the nickel layer and form the nickel silicide (NiSi) contacts and removing the nickel that did not react to form the nickel silicide (Fig. 9, col. 6, lines 40-45).

Bai does not explicitly describe the dopant concentration as being supersaturated. However, Applicant admitted prior art teaches forming supersaturated dopant concentration on the extension to reduce the resistivity of the extensions (page1).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to recognize that the dopant concentration taught by Bai is supersaturated as taught Applicant admitted prior art. The modification would provide a

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method of forming reduced resistivity extensions while maintaining the thickness of the silicide layer (Bai, col. 2, lines 50-52).

4. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331) and Applicant admitted prior art as applied to claims 1-3, 5 above, and further in view of Hsu (U.S. 5,491,099).

Regarding claim 4, the combination of Bai and Applicant admitted prior art does not specifically show removing the spacers prior to forming the source/drain extensions. However, Hsu teaches removing the spacers prior to forming the source/drain extensions and forming a second insulating layer to form second sidewall spacers (Fig. 4-9, col. 3, lines 25-45, 56-60, col. 4, lines 3-20).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai and Applicant admitted prior art by including the conventional step of removing the spacers as taught Hsu in order to reduce risk of hot electron reliability failures (Hsu, col. 2, lines 1-2).

5. Claims 6-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331) in view of Applicant admitted prior art as applied to claims 1-3, 5 above, and further in view of Murthy et al. (U.S. 6,235,568).

Regarding claims 6-7, the combination of Bai and Applicant admitted prior art does not specifically show the time and the concentration as claimed. However, Murthy et al. discloses the metal silicide contacts being NiSi formed at a temperature of 400°C to about 700°C for approximately 20-30 seconds (col. 9, lines 22-30, col. 9, lines 42-47).

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Murthy et al. teaches a dopant concentration being about 10^{21} ions/cm³ by implanting a dosage about 1×10^{15} - 1×10^{16} atoms/cm² and an energy of between 30-80 keV (col. 6, lines 20-30).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai and Applicant admitted prior art by including the time and concentration taught by Murthy et al. in order to obtain the high dopant concentration taught by Bai. In addition, "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

6. Claims 8-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331) in view of Applicant admitted prior art as applied to claims 1-3 and 5 above, and further in view of Tsukamoto (U.S. 5,399,506)

Regarding claims 8-9, the combination of Bai and Applicant admitted prior art does not specifically show exposing employing laser radiation with the specific energy as claimed. However, Tsukamoto shows employing laser radiation with an energy density ranging from 650 to 1100 nJ/cm² (Abstract, col. 3, lines 1-5, col. 4, lines 30-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai and Applicant admitted prior art by employing laser radiation as taught Tsukamoto in order to reduce leakage current (Tsukamoto, Abstract).

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7. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331) and Applicant admitted prior art as applied to claims 1-3, 5 above, and further in view of Ozturk et al. (U.S. 5,242,847).

Regarding claims 10-11, the combination of Bai and Applicant admitted prior art does not specifically show forming the source/drain extensions by doped selective epitaxy by applying a gas mixture comprising SiH_4 , the temperature and pressure as claimed. However, Ozturk et al. teaches doping the substrate by selective epitaxy employing SiH_4 , employing the temperature of about 500°C to about 800°C and the pressure of 2.5 torr (col. 6, lines 20-30, col. 7, lines 18-25).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai and Applicant admitted prior art by including the teaching of Ozturk et al. in order to form shallow doped regions (Ozturk et al., col. 3, lines 35-45).

8. Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331) in view of Applicant admitted prior art and Hsu (U.S. 5,491,099).

Bai teaches providing a semiconductor substrate (silicon) having an upper surface, a gate electrode formed on the upper surface of the substrate with a gate insulating layer therebetween, the gate electrode having an upper surface and source/drain regions (Fig. 5-7, col. 3, lines 50-65, col. 5, lines 20-30, 40-45). Bai discloses forming source/drain extensions having a dopant concentration, forming metal silicide contacts on the upper surface of the gate electrode and the substrate in a manner

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sufficient to maintain the dopant concentration in the source/drain extensions (Fig. 7-9, col. 6, lines 15-20, 25-45).

In addition, Bai shows the temperature being below about 700°C throughout the forming of the metal silicide contacts (col. 6, lines 42-44). Bai discloses the metal silicide contacts being NiSi formed at a temperature of approximately 400-600°C (col. 6, lines 42-44). Bai teaches depositing a dielectric layer over the substrate and the gate electrode upper surfaces, patterning the dielectric layer to form sidewall spacers, depositing a nickel layer over the gate electrode, the substrate, and the sidewall spacers (Fig. 5-8, col. 5, lines 49-52). Bai discloses heating to react the nickel layer and form the nickel silicide (NiSi) contacts and removing the nickel that did not react to form the nickel silicide (Fig. 9, col. 6, lines 40-45).

Bai does not explicitly describe the dopant concentration as being supersaturated. However, Applicant admitted prior art teaches forming supersaturated dopant concentration on the extension to reduce the resistivity of the extensions (page1).

Bai does not specifically show removing the spacers prior to forming the source/drain extensions. However, Hsu teaches removing the spacers prior to forming the source/drain extensions and forming a second insulating layer to form second sidewall spacers (Fig. 4-9, col. 3, lines 25-45, 56-60, col. 4, lines 3-20).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to recognize that the dopant concentration taught by Bai is supersaturated as taught Applicant admitted prior art and to include the conventional

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step of removing the spacers as taught Hsu. The modification would provide a method of forming reduced resistivity extensions while maintaining the thickness of the silicide layer (Bai, col. 2, lines 50-52) and reducing the risk of hot electron reliability failures (Hsu, col. 2, lines 1-2).

9. Claims 14-15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331), Applicant admitted prior art, and Hsu (U.S. 5,491,099) as applied to claims 12-13 above, and further in view of Ozturk et al. (U.S. 5,242,847).

Regarding claims 14-15, the combination of Bai, Applicant admitted prior art, and Hsu does not specifically show forming the source/drain extensions by doped selective epitaxy by applying a gas mixture comprising SiH_4 , the temperature and pressure as claimed. However, Ozturk et al. teaches doping the substrate by selective epitaxy employing SiH_4 , employing the temperature of about 500°C to about 800°C and the pressure of 2.5 torr (col. 6, lines 20-30, col. 7, lines 18-25).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai; Applicant admitted prior art, and Hsu by including the teaching of Ozturk et al. in order to form shallow doped regions (Ozturk et al., col. 3, lines 35-45).

10. Claims 16-17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331), Applicant admitted prior art, and Hsu (U.S. 5,491,099) as applied to claims 12-13 above, and further in view of Tsukamoto (U.S. 5,399,506).

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Regarding claims 16-17, the combination of Bai, Applicant admitted prior art, and Hsu does not specifically show exposing employing laser radiation with the specific energy as claimed. However, Tsukamoto shows employing laser radiation with an energy density ranging from 650 to 1100 nJ/cm² (Abstract, col. 3, lines 1-5, col. 4, lines 30-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai, Applicant admitted prior art, and Hsu by employing laser radiation as taught Tsukamoto in order to reduce leakage current (Tsukamoto, Abstract).

11. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bai (U.S. 5,889,331), Applicant admitted prior art, and Hsu (U.S. 5,491,099) as applied to claims 12-13 above, and further in view of Murthy et al. (U.S. 6,235,568).

Regarding claim 18, the combination of Bai, Applicant admitted prior art, and Hsu does not specifically show the dopant concentration being about 10²¹ ions/cm³. However, Murthy et al. teaches the concentration being 10²¹ ions/cm³ (col. 1, lines 60-65, col. 3, lines 40-46, col. 5, lines 10-15, col. 6, lines 20-30).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Bai, Applicant admitted prior art, and Hsu by specifying by including concentration taught by Murthy et al. in order to obtain the high dopant concentration taught by Bai. In addition, "where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the

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optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

Response to Arguments

12. Applicant's arguments filed December 23, 2003 have been fully considered but they are not persuasive. Claims 1-18 stand rejected.

Applicant argued that the forming supersaturated dopant concentration on the extension to reduce the resistivity of the extensions described on page 1 of the specification is not admitted prior art. However, the description is part of the background of the invention describing a known problem (page 1). Therefore, the description is admitted prior art because it is not describe as applicant work. When applicant states that something is prior art, it is taken as being available as prior art against the claims. Admitted prior art can be used in obviousness rejections. In re Nomiya, 509 F.2d 566, 184 USPQ 607, *611< (CCPA 1975).

In addition, Applicant admitted prior art is cited as evidence to show that it would have been obvious to a person of ordinary skill in the art at the time of the invention to recognize that the dopant concentration taught by Bai is supersaturated.

Furthermore, during examination, the claims must be interpreted as broadly as their terms reasonably allow. This means that the words of the claim must be given their plain meaning unless applicant has provided a clear definition in the specification. In re Zletz, 893 F.2d 319, 321, 13 USPQ2d 1320, 1322 (Fed. Cir. 1989); MSM Investments Co. v. Carolwood Corp., 259 F.3d 1335, 1339-40, 59 USPQ2d 1856, 1859-60 (Fed. Cir. 2001).

Conclusion

13. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).


A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Maria Guerrero whose telephone number is 571-272-1837.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on 571-272-1852. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Maria Guerrero
Primary Examiner
March 11, 2004